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Original Research Article

Intraocular Pressure Assessment and Comparison in Diabetes Mellitus and Non-Diabetics

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Abstract

Aim: The aim of the present study was to compare the intraocular pressure in diabetes mellitus and non-diabetic's individuals. **Methods:** This prospective observational study was done in the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for 1 year, all the Patients having diabetes mellitus on treatment and non-diabetic individuals was included in this study. Two groups were formed which includes Group A constituting diabetes mellitus patients and Group B constitutes non-diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c was recorded. Intra ocular pressure was compared between Group A and Group B, to correlate intra ocular pressure in relation to duration of diabetes mellitus and different stages of diabetic retinopathy. **Results:** 160 patients were included in our study. 68 patients had Type 2 diabetes mellitus (all were non-insulin dependent) and 12 patients had Type 1 diabetes mellitus (all were insulin dependent), and 80 patients were non-diabetics subjects. Mean age of non-diabetics was 47.98±10.33 years and that of diabetics 50.88±10.36 years (p valve 0.24) statistically not significant. In those 80 diabetic patients 55 were male and 25 were female. Mean age of male subjects was 52.88±10.69 years and that of female was 51.87±10.67 years in diabetic group which was not statistically significant (p value 0.27). Mean intra-ocular pressure higher (18.33±3.02 mmHg) in diabetic patients as compared with (16.12±2.97 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. Mean intra ocular pressure was (19.88±2.77mmHg) in diabetic patients with duration greater than 10 years as compared with (19.03±3.03mmHg) in diabetic patients with duration less than 10 years, p value <0.27which is not significant. Mean intra-ocular pressure (20.37±2.99 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (19.02±2.59 mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant. **Conclusion:** Diabetes mellitus is a risk factor for raised IOP. Tight glycemic control prevents the rise in IOP. Patients with poor glycemic control were found to be more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden ocular morbidity due to glaucoma can be reduced.

Keywords: Intraocular Pressure, Diabetes Mellitus.

Introduction

The intraocular pressure is determined by the balance between the production of aqueous humour and its drainage. Various factors may influence the level of intraocular pressure(IOP) e.g. age, sex, blood pressure, body mass index, diabetes etc.[1,2] Elevated intraocular pressure is a significant risk factor for the development of primary open angle glaucoma (POAG). Glaucoma is the leading cause of blindness in the world[1]. Diabetes mellitus is a major health problem in India, with its incidence increasing every day. Diabetes is associated with long term damage to various organs such as eye, kidney, heart, blood vessels and nerves. Diabetes mellitus has emerged as a major cause of vision loss and visual disability, developing and also in developed countries. Besides its other ocular manifestations, diabetes also affects intra ocular pressure[3]. The association of diabetes with elevated intraocular pressure and primary open angle glaucoma is controversial. The mechanism that causes higher intraocular pressure is not clear, but various etiologies has been postulated as genetic, autonomic dysfunction, and osmotic diffusion[4]. Many studies have shown diabetes mellitus (DM) in association with intraocular pressure and open angle glaucoma. Others have found no association between diabetes and intraocular pressure[5,6]. Many factors, such as age, body mass index (BMI)[7], blood pressure (BP)[8], blood glucose[9,10], central corneal thickness (CCT), have been reported to associate with IOP, but their results were not entirely consistent in all studies, and the potential risk factors in their analysis were failed to account due to lack of data. Therefore, population-based studies with larger sample size and detailed information are needed to better understand these issues. To be noted, diabetes has become a global epidemic problem. It has been estimated that there were 451 million (age 18–99 years) people with diabetes in 2017, and these figures were expected to increase to 693 million by 2045[11]. It remains equivocal whether diabetic populations have different distribution or risk factors for IOP, and the association of diabetes with glaucoma has still been controversial, despite the fact that people with diabetes are twice likely to develop glaucoma compared with non diabetes[12]. Therefore, data on IOP distribution and risk factors in diabetic populations are needed to clarify the relationship between glaucoma and diabetes and plan effective prevention strategies.

Intraocular pressure may become elevated due to anatomical problems, inflammation of the eye, genetic factors, or as a side-effect from medication. Intraocular pressure laws follow fundamentally from physics. Any kinds of intraocular surgery should be done by considering the intraocular pressure fluctuation. Sudden increase of intraocular pressure can lead to intraocular micro barotrauma and cause ischemic effects and mechanical stress to retinal nerve fiber layer. Sudden intraocular pressure drop can lead to intraocular decompression that generates micro bubbles that potentially cause multiple micro emboli and leading to hypoxia, ischemia and retinal microstructure damage[13]. Glaucoma is a disease condition characterized by chronic progressive optic neuropathy and typical visual field changes. Elevated IOP is the major risk factor for glaucoma. The aim of the present study was to compare the

intraocular pressure in diabetes mellitus and non-diabetic's individuals.

Material and methods

The present study was conducted in the Department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India for 1 year. after taking the approval of the protocol review committee and institutional ethics committee.

Two groups were formed which includes Group A constituting diabetes mellitus patients and Group B constitutes non-diabetic individuals. Detailed history of diabetes mellitus patient was taken regarding duration of diabetes, treatment, fasting, post prandial blood sugar levels and HbA1c will be recorded.

All the patients of Group A and Group B were undergone complete ophthalmic examination, which includes best corrected visual acuity, slit lamp anterior segment examination, slit lamp biomicroscopy (+90D)/ indirect ophthalmoscopy for posterior segment examination, Perkins applanation tonometry to measure intra ocular pressure. Gonioscopy was done if required. For posterior segment examination pupils was dilated using mydriatics and slit lamp biomicroscopic/ indirect ophthalmoscopy examination was done to find out the diabetic retinopathy changes and classified according to the ETDRS classification. Intra ocular pressure were compared between Group A and Group B, to correlate intra ocular pressure in relation to duration of diabetes mellitus and different stages of diabetic retinopathy. Diabetic retinopathy changes were classified according to the ETDRS classification (Non proliferative and proliferative diabetic retinopathy).

Inclusion Criteria

- Patients with diabetes mellitus.
- Age group 20-62 years.
- Non diabetic individuals

Exclusion Criteria

- Patients having corneal pathology and any other ocular abnormalities like pterygium, entropion, trichiasis.
- Patients who have undergone previous ocular surgeries.
- Contact lens wearers.
- Patients on topical and systemic steroids.
- Patients having refractive error greater than ± 6D spherical or cylinder greater than ±3D.
- Pregnant women.

Results

160 patients were included in our study. 68 patients had Type 2 diabetes mellitus (all were non-insulin dependent) and 12 patients had Type 1 diabetes mellitus (all were insulin dependent), and 80 patients were non-diabetics subjects. Mean age of non-diabetics was 47.98±10.33 years and that of diabetics 50.88±10.36 years (p valve 0.24) statistically not significant. In those 80 diabetic patients 55 were male and 25 were female. Mean age of male subjects was 52.88±10.69 years and that of female was 51.87±10.67 years in diabetic group which was not statistically significant (p value 0.27).

Table 1: Mean IOP of patients of diabetics and non-diabetics

Patients	n	Mean IOP (mmHg)	SD	p-value
Diabetics	80	19.33	3.02	P<0.0001*
Non-Diabetics	80	16.12	2.97	

Table 1 shows mean intra-ocular pressure higher (18.33±3.02 mmHg) in diabetic patients as compared with (16.12±2.97 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant.

Table 2: Mean IOP of patients with Duration of diabetes

Duration of diabetes	Mean IOP (mmHg)	SD	p-value
<10 years	19.03	3.03	P<0.27
>10 years	19.88	2.77	

Table 2 shows mean intra ocular pressure was (19.88±2.77mmHg) in diabetic patients with duration greater than 10 years as compared with (19.03±3.03mmHg) in diabetic patients with duration less than 10 years, p value <0.27which is not significant.

Table 3: Mean IOP of patients with HbA1c

HbA1c	Mean IOP	± SD	p-value
<6.5	19.02	2.59	<0.0005*
>6.5	20.37	2.99	

Table 3 shows mean intra-ocular pressure (20.37±2.99 mmHg) higher in diabetic patients with HbA1c value >6.5% as compared (19.02±2.59 mmHg) with diabetic patients with HbA1c value <6.5%, p value < 0.0005 which is statistically significant.

Table 4: Mean IOP f patients with diabetic Retinopathy

Diabetic Retinopathy	Mean IOP	± SD	p-value
NPDR	20.55	2.87	<0.0001*
PDR	15.78	1.88	

Table 4 shows mean intraocular pressure lower in patients who have proliferative diabetic retinopathy than in those patients having non-proliferative diabetic retinopathy, p value <0.0001 which is statistically significant.

Discussion

Intraocular pressure (IOP) is the fluid pressure inside the eye. Tonometry is the method eye care professionals use to determine this. IOP is an important aspect in the evaluation of patients at risk of glaucoma. Most tonometers are calibrated to measure pressure in millimetres of mercury (mmHg). Intraocular pressure is determined by the production and drainage of aqueous humour by the ciliary body and its drainage via the trabecular meshwork and uveoscleral outflow. The reason for this is because the vitreous humour in the posterior segment has a relatively fixed volume and thus does not affect intraocular pressure regulation.

Intraocular pressure constitutes as a major risk factor for the emergence of glaucoma, an ophthalmological condition associated with DM[14]. DM and IOP are related in a way that the elevated blood glucose results in the induction of an osmotic gradient which leads to fluid shifts into the intraocular space[15].

Glaucoma is the world's leading cause of acquired blindness[16]. Glaucoma is an optic neuropathy characterized by progressive degeneration of retinal ganglion cells and their axons, manifested by increasing optic disc cupping and deterioration of visual function[17]. The round firm shape to the eyeball is caused by the intra ocular pressure (IOP) within the eyeball which is caused by the aqueous humour and vitreous body. Importance of IOP is in maintaining the structural and functional integrity of the eye. High intraocular pressure is more often associated with glaucomatous optic nerve damage. IOP is not the only risk factor for optic nerve damage but is one of the modifiable risk factors for emergence of glaucoma and is the only amendable risk factor that can be treated[18].

Our study shows mean intra-ocular pressure higher (18.33±3.02 mmHg) in diabetic patients as compared with (16.12±2.97 mmHg) in non-diabetic, p value < 0.0001 which is statistically significant. Study conducted by Jain and Luthra, reported that

mean intraocular pressure in diabetic eyes is slightly higher than nondiabetic eyes[19]. Contrary to our study, study conducted by Tielsch JM, Katz J et al Baltimore eye survey could not show any positive co-relation between diabetes and elevated intra ocular pressure(POAG) as compared to non-diabetic individuals[20].

In our study it was observed that mean intra ocular pressure was (19.88±2.77mmHg) in diabetic patients with duration greater than 10 years as compared with (19.03±3.03mmHg) in diabetic patients with duration less than 10 years, p value <0.27which is not significant.

A study conducted by Oshitari T., Fujimoto N et al showed higher intraocular pressure with chronic hyperglycaemia i.e >6.5%[21]. Baisakhiya S, Garg P et al also had similar finding, mean IOP of diabetic subjects with HBA1C<7% was 16.9±0.43 mm Hg and with HBA1C>8% was 18.62±0.22 mm of Hg (P<0.005) which was significantly higher[22]. In our study the mean intraocular pressure was lower in patients who had proliferative diabetic retinopathy than in those patients having non-proliferative diabetic retinopathy, p value <0.0001 which is statistically significant. Study conducted by Cristiansson (1961) also reported low IOP in proliferative retinopathy compared to non-proliferative retinopathy[23]. On the contrary one of the studies conducted by Masato Matsuoka, Nahoko Ogata et al showed IOP in each diabetic retinopathy group was significantly higher than that in their nondiabetic group (*P*<0.001), but there was no significant difference between the diabetic retinopathy groups. P<0.001[24].

Conclusion

The present study concluded that diabetes mellitus is a risk factor for raised IOP. Tight glycemic control prevents the rise in IOP. Patients with poor glycemic control were found to be more prone to raised IOP. Diabetic patients should be regularly screened for IOP so that burden ocular morbidity due to glaucoma can be reduced.

Reference

1. Hennis A, Wu S-Y, Nemesure B, Leske MC, Barbados Eye Studies Group. Hypertension, diabetes, and longitudinal changes in intraocular pressure. Ophthalmology. 2003; 110:908–14
2. Nomura H, Shimokata H, Ando F, Miyake Y, Kuzuya F. Age-related changes in intraocular pressure in a large Japanese population: a cross-sectional and longitudinal study. Ophthalmology. 1999; 106:2016–22.
3. 3. Anandha Lakshmi S, Petricia H, Saravanan A, Ramachandran C. Intraocular pressure in subjects with type 2 Diabetes Mellitus.Journal of Clinical and Diagnostic Research. 2011; 5:1336-8.
4. 4. Matsuoka M, Ogata N, Matsuyama K, Yoshikawa T, Takahashi K. Intraocular pressure in Japanese diabetic patients. Clin Ophthalmol Auckl NZ. 2012; 6:1005–9.
5. 5. Tielsch JM, Katz J, Quigley HA, Javitt JC, Sommer A. Diabetes, intraocular pressure, and primary open-angle glaucoma in the Baltimore Eye Survey. Ophthalmology. 1995; 102:48–53.
6. 6. De Voogd S, Ikram MK, Wolfs RC, et al. Is diabetes mellitus a risk factor for open-angle glaucoma? The Rotterdam Study. Ophthalmology. 2006; 113:1827–1831
7. Wang YX, Xu L, Zhang XH, et al. Five-year change in intraocular pressure associated with changes in arterial blood pressure and body mass index. The Beijing Eye Study. PLoS One. 2013;8: e77180.
8. Yokomichi H, Kashiwagi K, Kitamura K, et al. Evaluation of the associations between changes in intraocular pressure and metabolic

syndrome parameters: a retrospective cohort study in Japan. BMJ Open. 2016;6: e010360.
9. Zhao D, Cho J, Kim MH, et al. Diabetes, fasting glucose, and the risk of glaucoma: a meta-analysis. Ophthalmology. 2015; 122:72–78.
10. Luo XY, Tan NYQ, Chee ML, et al. Direct and indirect associations between diabetes and intraocular pressure: The Singapore Epidemiology of Eye Diseases Study. Invest Ophthalmol Vis Sci. 2018; 59:2205–2211.
11. Cho NH, Shaw JE, Karuranga S, et al. IDF diabetes atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Res Clin Pract. 2018; 138:271–281.
12. Zhao YX, Chen XW. Diabetes and risk of glaucoma: systematic review and a meta-analysis of prospective cohort studies. Int J Ophthalmol. 2017; 10:1430–1435
13. Pardianto G. "Recent awareness and consideration of intraocular pressure fluctuation during eye surgery". J Cataract Refract Surg. 2015; 41(3):695
14. Leske CM, Connel AMS, Wu SY, Hyman LG, Schachat AP. Risk factors for open-angle glaucoma. Arch Ophthalmol 1995; 113:918-24.
15. Hollows FC, Graham PA. Intra-ocular pressure, glaucoma, and glaucoma suspects in a defined population. Br J Ophthalmol. 1966; 50:570–586.
16. Kohli PG, Kaur H, Maini H. Relation of Body mass index with intraocular pressure. Indian Journal of Basic and Applied Medical Research. 2014; 3(2):679-81.
17. Pedro-Egbe CN, Awoyesuku EA, Nathaniel GI, Komolafe RO. The relationship between Body mass Index and Intraocular Pressure in Port Harcourt Nigeria. Br J of Medicine& Medical Research. 2013; 3(3):589- 95.
18. Patil S, Herur A, Shashikala GV, Chinnagudi S, Manjula R, Ankad R, et al. Corelation of IOP with blood pressure and BMI in offsprings of diabetic patients: A Cross sectional study. Int J Med Res Health Sci. 2014; 3(3):566-9
19. Jain, IS. and Lnthra, CL.: Diabetic retinopathy, its relationship with in traocular pressure. Arch Oph (Chica go) 1967; 78:198.
20. Tielsch JM, Katz J, Quigley HA, Javitt JC, Sommer A. Diabetes, intraocular pressure, and primary open-angle glaucoma in the Baltimore Eye Survey. Ophthalmology. 1995;102(1):48-53.
21. Oshitari T, Fujimoto N, Hanawa K, Adachi-Usami E. Effect of Chronic Hyperglycemia on Intraocular Pressure in Patients with Diabetes. Am J Ophthalmol, 2007;143(2):363-5.
22. Baisakhiya S, Garg P, Singh S. Association between glycemic control and intraocular pressure in patients of Type II diabetes mellitus. Natl J Physiol Pharm Pharmacol 2017;7(1):43-6.
23. Cristiansson, J., Intraocular pressure in diabetes mellitus, Acta. Ophthalmol 1961; 39:159
24. Matsuoka M, Ogata N, Matsuyama K, Yoshikawa T, Takahashi K. Intraocular pressure in Japanese diabetic patients. Clin Ophthalmol Auckl NZ. 2012; 6:1005–9.